CLAIMS

1. A tungsten-based sintered material having high strength and high hardness comprising nickel (Ni) in a range from 0.2 to 1.5% by mass, and yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, the balance being tungsten (W); wherein

tungsten phases are sinter-bonded;

fine nickel phase and yttrium oxide phase which have a largest particle diameter of 5 μm or less are distributed at boundaries of the tungsten phases; and

a largest particle diameter of the tungsten phase is 30 μm or less.

2. A tungsten-based sintered material having high strength and high hardness comprising nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, and vanadium carbide (VC) in a range from 0.05 to 0.5% by mass, the balance being tungsten (W); wherein

tungsten phases are sinter-bonded;

fine nickel phase and yttrium oxide phase which have a largest particle diameter of 5 μm or less are distributed at boundaries of the tungsten phases; and

a largest particle diameter of the tungsten phase is 20 μm or less.

3. A tungsten-based sintered material having high strength and high hardness comprising: nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, and at least one of cobalt (Co) and iron (Fe) in a range from 0.01 to 0.5% by mass, the balance being tungsten (W); wherein

tungsten phases are sinter-bonded;

any one of fine Ni-Co alloy phase, Ni-Fe alloy phase, and Ni-Co-Fe alloy phase

which have a largest particle diameter of 5 μm or less and yttrium oxide phase which has a largest particle diameter of 5 μm or less are distributed at boundaries of the tungsten phases; and

a largest particle diameter of the tungsten phase is 30 μm or less.

4. A tungsten-based sintered material having high strength and high hardness comprising: nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, vanadium carbide (VC) in a range from 0.05 to 0.5% by mass, and at least one of cobalt (Co) and iron (Fe) in a range from 0.01 to 0.5% by mass, the balance being tungsten (W); wherein

tungsten phases are sinter-bonded;

any one of fine Ni-Co alloy phase, Ni-Fe alloy phase, and Ni-Co-Fe alloy phase which have a largest particle diameter of 5 μm or less and yttrium oxide phase which has a largest particle diameter of 5 μm or less are distributed at boundaries of the tungsten phases; and

a largest particle diameter of the tungsten phase is 20 μm or less.

5. A tungsten-based sintered material having high strength and high hardness comprising: nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, and at least one of molybdenum (Mo), chromium (Cr), niobium (Nb), and rhenium (Re): 0.5 to 4%; the balance being tungsten (W); wherein

W-M alloy phases (wherein M denotes at least one of Mo, Cr, Nb, and Re) are sinter-bonded;

any one of fine Ni phase having a largest particle diameter of 5 μm or less and yttrium oxide phase having a largest particle diameter of 5 μm or less are distributed at

boundaries of the W-M alloy phases; and

a largest particle diameter of the W-M alloy phase is 30 μm or less.

6. A tungsten-based sintered material having high strength and high hardness comprising: nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, at least one of molybdenum (Mo), chromium (Cr), niobium (Nb), and rhenium (Re): 0.5 to 4%; and vanadium carbide (VC) in a range from 0.05 to 0.5% by mass, the balance being tungsten (W); wherein

W-M alloy phases (wherein M denotes at least one of Mo, Cr, Nb, and Re) are sinter-bonded;

any one of fine Ni phase having a largest particle diameter of 5 μm or less and yttrium oxide phase having a largest particle diameter of 5 μm or less are distributed at boundaries of the W-M alloy phases; and

a largest particle diameter of the W-M alloy phase is 15 μm or less.

7. A tungsten-based sintered material having high strength and high hardness comprising: nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, at least one of molybdenum (Mo), chromium (Cr), niobium (Nb), and rhenium (Re): 0.5 to 4%; and at least one of cobalt (Co) and iron (Fe) in a range from 0.01 to 0.5% by mass, the balance being tungsten (W); wherein

W-M alloy phases (wherein M denotes at least one of Mo, Cr, Nb, and Re) are sinter-bonded;

any one of fine Ni-Co alloy phase, Ni-Fe alloy phase, and Ni-Co-Fe alloy phase which have a largest particle diameter of 5 μm or less and yttrium oxide phase which has a largest particle diameter of 5 μm or less are distributed at boundaries of the tungsten phases;

and

a largest particle diameter of the W-M alloy phase is 30 μm or less.

8. A tungsten-based sintered material having high strength and high hardness comprising: nickel (Ni) in a range from 0.2 to 1.5% by mass, yttrium oxide (Y_2O_3) in a range from 0.1 to 1% by mass, at least one of molybdenum (Mo), chromium (Cr), niobium (Nb), and rhenium (Re): 0.5 to 4%; vanadium carbide (VC) in a range from 0.05 to 0.5% by mass, and at least one of cobalt (Co) and iron (Fe) in a range from 0.01 to 0.5% by mass, the balance being tungsten (W); wherein

W-M alloy phases (wherein M denotes at least one of Mo, Cr, Nb, and Re) are sinter-bonded;

any one of fine Ni phase having a largest particle diameter of 5 μm or less and yttrium oxide phase having a largest particle diameter of 5 μm or less are distributed at boundaries of the W-M alloy phases; and

a largest particle diameter of the W-M alloy phase is 15 μm or less.

9. A hot press mold for optical glass lenses composed at least partly of the tungsten-based sintered material according to any one of claims 1 to 8.